TENNESSEE DEPARTMENT OF EDUCATION
FIRST TO THE TOP

Fire Science I

Primary Career Cluster:	Law, Public Safety, Corrections and Security
Consultant:	Amy F. Howell, (615) 532-2839, Amy.F.Howell@tn.gov
Course Code(s):	6152
Prerequisite(s):	*Principles of Fire and Emergency Services* (6154) and *Emergency Preparedness* (6151)
Credit:	1
Grade Level:	11
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Law and Public Safety courses.
Programs of Study and Sequence:	This is the third course in the *Fire Management Services* program of study.
Aligned Student Organization(s):	SkillsUSA: http://www.tnskillsusa.org Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit http://tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	None
Dual Credit or Dual Enrollment Opportunities:	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
Teacher Endorsement(s):	751
Required Teacher Certifications/Training:	Tennessee Fire Commission Fire Fighter Instructor 1
Teacher Resources:	http://www.tn.gov/education/cte/LawPublicSafetyCorrectionsSecurity.shtml

Course Description

Fire Science I is the third course in the *Fire Management Services* program of study. In this course, students will be prepared with technical knowledge and skills related to firefighter safety, fire behavior, building construction guidelines, and the use of firefighting equipment. Upon completion of this course, proficient students will be able to correctly demonstrate skills associated with ropes, ladders, and fire

hoses in a non-live fire situation. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects as well as the National Fire Protection Association (NFPA) standards.*

Program of Study Application

This is the third course in the *Fire Management Services* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Law, Public Safety, Corrections and Security website at http://www.tn.gov/education/cte/LawPublicSafetyCorrectionsSecurity.shtml.

Course Standards

Introduction to Fire Service Training

1) Perform the following skills of a basic level firefighter, as covered in the *Principles of Fire and Emergency Services* course, and articulate their importance:
    a. Levels of firefighters
    b. Organizational chart and chain of command of fire services
    c. National Incident Management System (NIMS) Incident Command System (ICS)-100 and NIMS ICS-700 skills (completed online)
    d. Use of Personal Protective Clothing and Equipment
    e. Self-Contained Breathing Apparatus (SCBA)
    f. Personal Alert Safety System (PASS)
    g. Scene Safety
    h. Emergency Communication, including mayday procedure
    i. Portable Fire Extinguisher use

    (TN Reading 3, 4)

Incident Command Systems (Firefighter Orientation)

2) Construct an organizational chart of responding personnel on the scene of an incident. Describe the roles and responsibilities of each person then develop an Incident Action Plan (IAP) for a structural fire, a commercial fire, and a motor vehicle accident to which fire personnel are expected to respond. (TN Reading 4, 5; TN Writing 4, 8)

3) Design a plan with distinct action items, justified with sound reasoning, for stakeholders in a disaster when the NIMS-ICS is implemented. Include in the plan the personnel groups and divisions, staging of personnel, and tactical resources involved for a large emergency. Review cases where ICS is implemented to assist with the plan. (TN Reading 2, 4, 5, 8; TN Writing 1, 9)

4) Outline the responsibilities of a local fire department when an emergency incident occurs according to NIMS. Discuss the importance of NIMS in such a situation and describe the requirements to deploy a NIMS-Incident Command System. (TN Reading 4, 5, 7, 8; TN Writing 9)

Safety and Health (Firefighter Safety and Health)

5) Research occupational hazards associated with firefighting. Identify standards of practice and acceptable firefighter health considerations that can prevent these hazards; develop a mock employee and wellness program based on findings, citing specific recommendations and data from the text. (TN Reading 1, 2, 7; TN Writing 4, 7)

6) Compare and contrast offensive and defensive operations at an emergency scene, including procedures related to personnel accountability, emergency escape, and rapid intervention. (TN Reading 5, 9)

Fire Behavior

7) Identify the physical, chemical, and kinetic changes that occur in a fire. Develop a written, oral, and digital informational presentation summarizing these changes and supplemented by relevant explanations of matter, exothermic heat reaction, endothermic heat reaction, heat, measurements of temperature, and sources of heat energy. (TN Reading 1, 7, 8; TN Writing 2, 4, 6)

8) Differentiate between the characteristics of a liquid fuel fire, a gas fuel fire, and a solid fuel fire. Include terminology specific to the science of fire in the explanation. Relate the types of fires in multiple structures such as inside structure, metal structure, or outside structure in an informative essay, citing information from textbooks or professional firefighter journals. (TN Reading 1, 2, 4, 9; TN Writing 2, 7, 9)

9) Summarize the stages of development of a fire in a compartment, examining the factors that can affect fire development. Explain in written format the multiple contributors to each stage, including specific terminology, possible preventive measures, and safety interventions. (TN Reading 2, 4, 8; TN Writing 2, 8, 9)

10) Explain the importance of understanding the concepts of thermal layering, rollover, flashover, isolated flames, hot-smoldering fire, and backdraft. Describe in a written, verbal, or graphic format the preventive measures and firefighter safety measures for each of these situations. (TN Reading 2, 4; TN Writing 2, 8, 9)

11) Firefighters can influence the behavior of a fire. Construct an explanation of the fire control theory, relating concepts of temperature reduction, fuel removal, oxygen exclusion, and chemical flame inhibition in a written or digital format. (TN Reading 2, 4, 9; TN Writing 6, 7, 8)

Building Construction

12) Describe the common building materials and articulate the hazards that firefighters will encounter with each. Incorporate appropriate construction terms for each material discussed. (TN Reading 4; TN Writing 9)

13) NFPA 220, *Standard on Types of Building Construction*, outlines the five types of building construction. Summarize each type, the materials involved, the structural strengths and weakness of each, and the associated hazards that firefighters can expect to encounter.

Estimate the growth and development of a fire according to the type of building construction. (TN Reading 4, 7, 8; TN Writing 8, 9)

14) Identify dangerous building conditions created by fire and fire suppression activities, including conditions that contribute to the spread and intensity of the fire, conditions that make the building susceptible to collapse, and the hazards associated with lightweight materials and truss construction. (TN Reading 2, 4; TN Writing 9)

15) Articulate common hazards related to electrical emergencies, and demonstrate acceptable procedures for shutting off electricity to a burning building. (TN Reading 2, 4; TN Writing 9)

Personal Protective Gear

16) Respiratory protection is very important in firefighting careers. Describe in detail the characteristics of effective air management. Distinguish among characteristics of toxic and non-toxic respiratory hazards, identifying physical, medical, and mental factors that affect the firefighter's ability to use respiratory protection effectively, including limitations, safety precautions, and signs and symptoms of oxygen deficiency. (TN Reading 1, 2, 4, 8; TN Writing 8, 9)

17) Compare and contrast the two types of self-contained breathing apparatus (SCBA) used in fire services. Identify the key functions and characteristics of the Personal Alert Safety System (PASS) or Personal Alert Device (PAD) systems and explain why they are required by NFPA 1500 standards. Understand concepts of and perform skills related to SCBA, such as:
    a. Don SBCA: Over the head method
    b. Don SCBA: Coat Method
    c. Don SCBA: Seat-Mount Method
    d. Doff SCBA
    e. Inspect SCBA
    f. Clean SCBA
    g. Fill SCBA cylinder from cascade system
    h. Controlled Breathing Techniques
    i. Exit a constricted opening wearing standard SCBA
    j. Change a SCBA - one person method
    k. Change a SCBA - two person method

    (TN Reading 2, 3, 4, 7)

Ropes and Knots

18) Compare and contrast a life-safety rope and a utility rope, addressing applicable NFPA standards, rope materials, strength, and construction. Demonstrate the ability to identify different types of rope, (i.e., a life-safety rope and a utility rope), and perform the skill of coiling and uncoiling ropes. (TN Reading 3, 4)

19) Articulate the importance of maintaining, caring for, and inspecting ropes; perform skills related to NFPA standards for inspecting, cleaning, and storing both types of rope. Identify conditions that would warrant a rope being taken out of service. (TN Reading 3, 4)

20) Describe the following components when preparing to tie knots:
    a. Parts of a rope
    b. Considerations in tying knots
    c. Elements of a knot
    d. Characteristics of knots commonly used in fire service
    e. Rope hardware

    (TN Reading 3)

21) When given the proper size and amount of rope, demonstrate tying the following knots:
    a. Tie the single overhand knot
    b. Tie a bowline
    c. Tie a clove hitch
    d. Tie a clove hitch around an object
    e. Tie a figure eight
    f. Tie a figure eight on a bight

    (TN Reading 3, 4)

22) Identify tools and equipment used in the practice of hoisting, incorporating safety precautions and demonstrating skills in identification related to the following:
    a. Hoisting an axe
    b. Hoisting a pike pole
    c. Hoisting a roof ladder
    d. Hoisting a dry hoseline
    e. Hoisting a power saw

    (TN Reading 3, 4)

Forcible Entry

23) Describe situations that would require forcible entry through a wood, metal, sliding, revolving, or overhead door; a window; a fire door; a gate; and a lock. Identify the tools that would be required for entry, and discuss the safety hazards and limitations of each tool. Perform the skills of cleaning, inspecting, and maintaining hand tools and equipment. (TN Reading 2, 3, 4, 6; TN Writing 8, 9)

24) Outline the procedures, safety precautions, use of tools, and special considerations involved in the breaching of walls and floors when entry in a door or window is not possible. Perform the skills related to forcible entry with 100% accuracy as outlined by the following:
    a. Forced entry through an inward-swinging door - two firefighter method
    b. Forced entry through an outward-swinging door - wedge-end method
    c. Forced entry using the through-the-lock method
    d. Forced entry using the through-the-lock method with the K-tool
    e. Forced entry using the through-the-lock method with the A-tool
    f. Forced entry through padlocks
    g. Forced entry through a double-hung window
    h. Forced entry through a glass pane window

    (TN Reading 3, 4)

Ground Ladders

25) Investigate the guidelines as stated by NFPA 1001 for firefighters concerning the use of ground ladders. Describe the types, parts, and functions of the ladder, materials used for ladder construction, and procedures for inspecting, cleaning, and maintaining ladders in a written or digital explanation. (TN Reading 1, 4, 5, 9; TN Writing 6, 9)

26) Write a mock scenario in which a ground ladder would be used by firefighter personnel. Identify the type of ladder required, the procedure for moving the ladder into place, the procedure for lifting and lowering the ladder, the procedure for climbing the ladder, and safety precautions when using the ladder. (TN Reading 2, 4; TN Writing 7, 9)

27) Understand the concepts of and perform the following skills with 100% accuracy related to ground ladders:
    a. Ladder Carry: one-firefighter low-shoulder method
    b. Ladder Carry: two-Firefighter low-shoulder method
    c. Ladder Carry: three-firefighter low-shoulder method
    d. Tie the Halyard
    e. Raise a ladder - one firefighter method single ladder
    a. Raise a ladder - one firefighter method extension ladder
    b. Raise a ladder - two firefighter flat raise
    c. Raise a ladder - two firefighter beam raise
    d. Raise a ladder - three- or four-two firefighter flat raise
    e. Deploy a roof ladder – one firefighter method
    f. Pivot a ladder - two firefighter method
    g. Shift a ladder - one firefighter method
    h. Shift a ladder - two firefighter method
    i. Leg lock on a ground ladder
    j. Assist a conscious victim down a ground ladder
    k. Assist an unconscious victim down a ground ladder

    (TN Reading 3, 4)

Standards Alignment Notes

*References to other standards include:

- TN Reading: State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 11-12 Students (page 62).
    - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects; Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 11-12 Students (pages 64-66).
    - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, and 10 at the conclusion of the course.

- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
    - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.
- National Fire Protection Association (NFPA) Fire Fighter Professional Qualifications